PATENT SPECIFICATION (11) 1 419 035

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(21) Application No. 7514/74 (22) Filed 19 Feb. 1974
(31) Convention Application No. 333 684
(32) Filed 20 Feb. 1973 in
(33) United States of America (US)
(44) Complete Specification published 24 Dec. 1975
(51) INT CL² B60K 11/00
(52) Index at acceptance
B7H A26B A26E A2F D
F4S 42J 42K 42M

(19)

(54) IMPROVEMENTS RELATING TO COOLING SYSTEMS

(71) We, CATERPILLAR TRACTOR CO., a corporation organised and existing under the laws of the State of California, United States of America, of 100 N.E. Adams Street, Peoria, State of Illinois 61602, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to cooling systems.

A conventional cooling system for an earthworking vehicle comprises at least one engine-driven fan assembly mounted adjacent to a radiator to pump air therethrough for engine cooling purposes. Various attempts have been made to reduce the unduly high noise level normally occasioned during operation of the fan assembly and its attendant mechanisms, without immolating safety or operating requirements. Such attempts have often resulted in a substantial increase in the complexity of the cooling system as well as its manufacturing costs.

According to the invention we provide a cooling system comprising first and second rotatably mounted fans having parallel and spaced planes of rotation and provided at opposite ends of a chamber for pumping air into said chamber, a baffle disposed generally parallel to the planes of rotation of said fans to separate said chamber into first and second compartments, drive means connected to said first and second fans, and first and second fluid cooling means extending parallel to each other and perpendicular to the planes of rotation of said fans, said first and second cooling means being spaced apart to define respective sides of said chamber, the arrangement being such that in operation air pumped into said chamber by said fans will exit through said first and second cooling means.

According to a further aspect of the invention we provide a vehicle including a cooling system as above set forth, said cooling system being mounted on a frame disposed at the rearward end of the vehicle, and said vehicle having an operator's station mounted on said vehicle, forwardly of said cooling system.

An embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:—

Fig. 1 is a side elevational view of a track-type loader having a cooling system according to the invention mounted on a rearward end thereof;

Fig. 2 is an enlarged, sectional view of the cooling system, taken in the direction of arrows II—II in Fig. 1; and

Fig. 3 is an enlarged section of a fan blade depicting the chordal angle thereof.

Referring to the drawings, a track-type loader 10 has a standard bucket arrangement 11 movably mounted on a forward end thereof. The loader further comprises an operator's station 12 and is mounted for movement on a pair of laterally spaced endless track assemblies 13 (one shown), driven by an engine 14. In particular, the engine is adapted to selectively rotate a pair of drive sprockets 15 (one shown) via an intermediate drive train, including a transmission 16.

A cooling system 17 is mounted on a rearward end of the loader 10, preferably above transmission 16. As shown in Fig. 2, the cooling system comprises first and second fans 18 and 19 secured to opposite ends of a common drive shaft 20 of a drive means, further including a pair of drive belts 21 driven by a power take-off from engine 14. The drive shaft is disposed on the longitudinal axis of the loader and is rotatably mounted on bracing means, such as cross-braces 22 and 23 secured to the loader's main frame, by bearings 24 and 25, respectively.

First and second laterally spaced and vertically disposed fluid cooling means, such

as conventional air-cooled radiators 26 and 27 suitably connected to the engine's cooling system, extend parallel to each other and perpendicular to the planes of rotation of the first and second fans 18 and 19 in parallel relationship with drive shaft 20. A third fluid cooling means, such as an oil cooler 28 for the transmission, is mounted on a rearward end of the vehicle and extends transversely of radiators 26 and 27 and adjacent fan 18. A first corner bracket 29 is secured to adjacent ends of cross-brace 22, radiator 26 and oil cooler 28.

The opposite end of cross-brace 22 is likewise secured to adjacent ends of radiator 27 and oil cooler 28 by a second corner bracket 30. The forward ends of radiators 26 and 27 are secured to opposite ends of cross-brace 23 by third and fourth bracket 31 and 32, respectively. Each of the four corner brackets 29, 30, 31 and 32, is attached to the frame of the vehicle by releasable fastening means, such as a bolt 33.

A baffle plate 34, detachably mounted between radiators 26 and 27, is preferably positioned intermediate first and second fans 18 and 19 and in parallel relationship therewith. It should be noted that an air-receiving chamber, defined on three sides by radiators 26 and 27 and oil cooler 28, is thus separated into first and second compartments 35 and 36 by the baffle plate which has suitably sized aperture 37 formed therethrough to accommodate drive shaft 20. The cooling system preferably further comprises a protective enclosure, including mesh screens or grills 38, 39 and 40, suitably integrated therein to facilitate unimpeded air flow therethrough.

During loader operation, fans 18 and 19 function to pump air into compartments 35 and 36, respectively. The area forward of fan 19 is open to the atmosphere to ensure a sufficient air supply thereto. The air is compressed in the compartments and flows through the cores of radiators 26 and 27 at a substantially increased pressure and density. The noise level of the cooling system is held to an acceptable low level in that baffle plate 34 functions to prevent undue air turbulence by inducing uniform air flow through the compartments.

The air pressure in compartments 35 and 36 may be uniformly balanced by providing different chordal angles for two or more blades 41 employed on fans 18 and 19. For example, referring to Fig. 3, a first chordal angle "*a*" for the blades of fan 18 may approximate twenty-seven degrees whereas a second and less chordal angle for the blades of forwardly disposed fan 19 may approximate twenty-four degrees. During testing, the two fans were found to circulate air at approximately 11,800 cfm through the system, when rotated at 600 rpm, to provide the required cooling desiderata.

The impulsion of air through screens 38 and 39 aids in carrying dust, normally raised by track assemblies 13 at drive sprockets 15, laterally outwardly from the vehicle. Such a dust-carrying function aids in permitting the fans to pump relatively dust-free air therethrough and further aids in increasing the operator's visibility, comfort and safety. It should be noted that the major portion of the cooling system can be expeditiously removed as a module by merely removing bolts 33, fan belts 21, and a detachable engine hood 42 (Fig. 1).

The cooling system affords an additional advantage in that service can be accomplished without disturbing sound suppressing material now used to protectively line most operators' stations. Such material must be carefully placed to seal all openings or avenues for possible transfer of noise toward the operator. It is for this reason that forwardly disposed, relatively remote screens or grills 43 are provided for introducing cooling air at the forward end of the module.

Thus the invention provides a simple and efficient cooling system which exhibits a low noise level and a high degree of safety in operation.

WHAT WE CLAIM IS:—

1. A cooling system comprising first and second rotatably mounted fans having parallel and spaced planes of rotation and provided at opposite ends of a chamber for pumping air into said chamber, a baffle disposed generally parallel to the planes of rotation of said fans to separate said chamber into first and second compartments, drive means connected to said first and second fans, and first and second fluid cooling means extending parallel to each other and perpendicular to the planes of rotation of said fans, said first and second cooling means being spaced apart to define respective sides of said chamber, the arrangement being such that in operation air pumped into said chamber by said fans will exit through said first and second cooling means.

2. A cooling system as claimed in claim 1 wherein said drive means comprises a drive shaft extending through said baffle and connected to said fans.

3. A cooling system as claimed in claim 1 or 2 wherein each of said first and second fluid cooling means comprises a radiator.

4. A cooling system as claimed in any preceding claim further comprising a third fluid cooling means extending transversely between said first and second cooling means to define a third side of said chamber.

5. A cooling system as claimed in claim 4 wherein said third fluid cooling means comprises an oil cooler.

6. A cooling system as claimed in any preceding claim further comprising a pair of first and second bracing means spaced along a common axis of rotation of said fans and detachably connected to a support, said bracing means extending transversely between and connected to said first and second fluid cooling means.

7. A cooling system as claimed in claim 6 further comprising a respective bracket secured to each end of each of said first and second fluid cooling means and further secured to each of said first and second bracing means, each of said brackets being removably attached to said support by releasable fastening means.

8. A cooling system as claimed in claim 6 or 7 wherein said drive means comprises a drive shaft rotatably mounted on each of said first and second bracing means by bearings and connected to said fans.

9. A cooling system as claimed in any preceding claim wherein each of said first and second fans comprises a plurality of fan blades, a first chordal angle of the fan blades of said first fan being greater than a second chordal angle of the fan blades of said second fan.

10. A cooling system as claimed in claim 9 wherein said first chordal angle approximates twenty-seven degrees and said second chordal angle approximates twenty-four degrees.

11. A vehicle including a cooling system as claimed in any of claims 1 to 10, said cooling system being mounted on a frame disposed at the rearward end of the vehicle, and said vehicle having an operator's station mounted on said vehicle, forwardly of said cooling system.

12. A vehicle as claimed in claim 11 comprising a pair of endless track assemblies, a respective drive sprocket connected to each of said endless track assemblies and means for rotating said drive sprockets.

13. A vehicle as claimed in claim 12 wherein said drive sprockets are positioned vertically below and adjacent said cooling system and wherein said first and second fluid cooling means are disposed generally parallel to the longitudinal axis of said vehicle whereby air exiting from said first and second fluid cooling means will impel dust raised by said track assemblies laterally away from said vehicle.

14. A vehicle substantially as hereinbefore described with reference to the accompanying drawings.

15. A cooling system substantially as hereinbefore described with reference to the accompanying drawings.

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Printed for Her Majesty's Stationery Office by the Courier Press, Leamington Spa, 1975.
Published by the Patent Office, 25 Southampton Buildings, London, WC2A 1AY, from which copies may be obtained.

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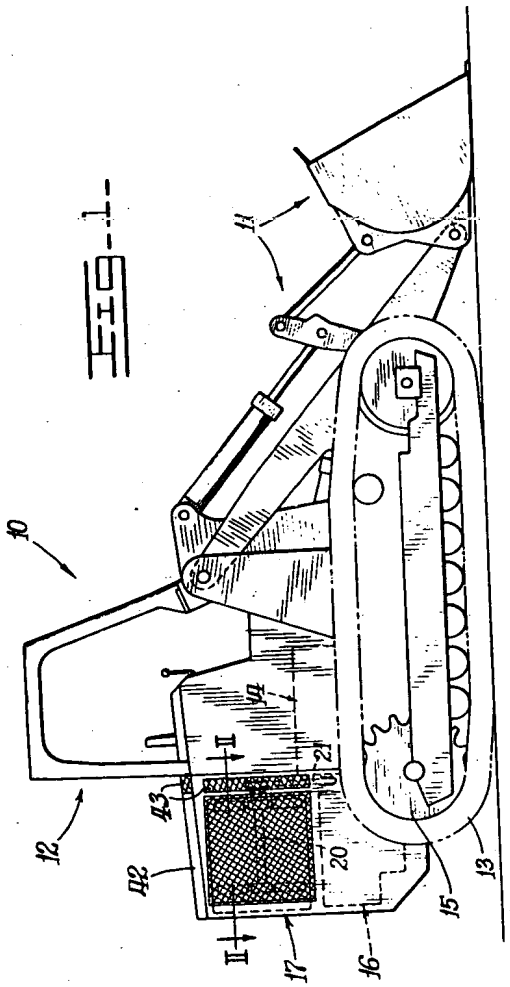
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1



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Sheet 2

Fig-2-

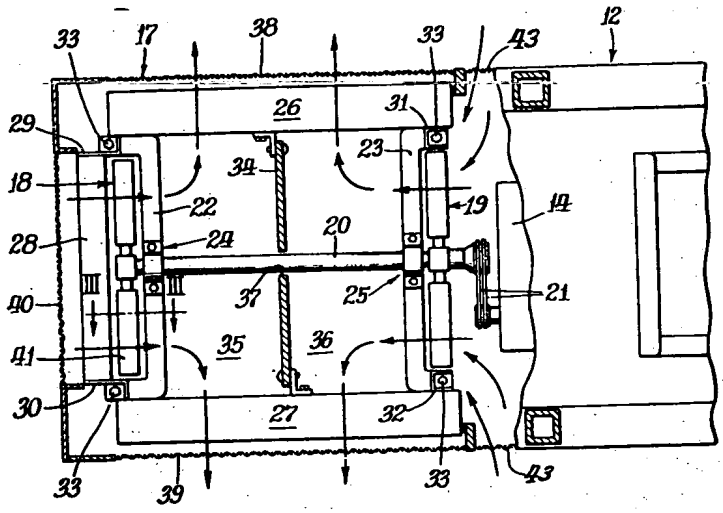

Fig-3-